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S&T Manpower (Trends and Forecasts)—China (U)

A Defense S&T Intelligence Study

Defense Intelligence Agency

Department of the Air Force

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S&T MANPOWER (TRENDS AND FORECASTS)—CHINA (U)

Authors: [redacted]

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PREFACE

(U) This study measures and discusses the professional scientific and technical (S&T) manpower resources that contribute to the scientific potential of China. It estimates and projects the size of the higher education establishment, trends in the number of students enrolled and graduated from colleges and universities, the size of the available S&T manpower pool, and the number of research and development (R&D) scientists and engineers in China.

(U) Contributions to this study were made by Mrs. [redacted] TQTM.

(U) Comments regarding the usefulness of this study are encouraged and should be forwarded to DIA (ATTN: DT-5A), Washington, D.C. 20301.

TABLE OF CONTENTS

EXP B3

LIST OF ILLUSTRATIONS

LIST OF TABLES

EXP B1

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SECTION I

INTRODUCTION (U)

(U) The availability and effective management of S&T manpower resources are essential to a nation's development. Of all the resources a nation commits to R&D objectives, none is so important as the numbers, types, and qualifications of the R&D scientists and engineers and the creative imagination that they can exercise. For that reason, S&T manpower estimates and assessments are pivotal in determining a nation's present and future capabilities to build a strong industrial base and to develop new and improved weapons. The manpower resource is also a constraint upon the extent and variety of R&D that a nation can undertake at any one time. Since it is a pacing factor, the measurement of the S&T manpower resource is vital to the assessment of a nation's near- and long-term ability to accept and attain industrial and military development objectives.

(U) This study examines professional S&T manpower as a Chinese resource. It further examines S&T higher education from a quantitative and qualitative view in order to establish trends from 1978 to the present in the growth of professional S&T manpower.

EXP B1

SECTION II

THE CHINESE HIGHER EDUCATION SYSTEM (U)

A. CULTURAL REVOLUTION IMPACT ON THE CHINESE EDUCATIONAL SYSTEM (U)

(U) The effect of the Cultural Revolution 1966-1970) and the period that followed (1971-1976) on Chinese higher education and S&T manpower was profound. All or nearly all, schools were closed for long periods. Some of the institutions either were physically relocated or remained closed. Formal education was suspended. Manpower in the education pipeline was "lost," probably permanently, and the educational system and standards were changed. These excesses had a significantly negative impact on Chinese society as the Red Guard radicals in power viewed the educational establishment as a powerful influence that had to be subjugated.

A.1. Conditions at Higher Schools During the Cultural Revolution (U)

(U) By the end of 1966, all but perhaps a few very special educational institutions in China had been closed. This shutdown included not only the regular training activities at higher schools but also the research facilities and projects at those institutions. The campuses were turned over to the Red Guard factions to carry out revolutionary activities. They were also used as marshalling areas for extending the Cultural Revolution to other institutions and sectors of Chinese society. Conditions at the schools were chaotic, particularly during 1966 and 1967.

A.2. Impact on Education Officials, Educators, and Researchers (U)

[redacted]

(U) Many scientists and engineers in leadership positions were replaced by political appointees and most professional associations, long an effective medium for exchanging scientific data, were disbanded. Further, professional titles such as "Researcher" or "Institute Director" were abolished, pay raises suspended, and other material and prestige benefits eliminated. Scientists were forced to spend agonizing hours away from their work in political activities.

(U) Theoretical research suffered the greatest blow as those practicing it or even advocating it were severely abused. The only research work acceptable to the radical element in control of most of the country was that which had an immediate application to production programs.

(U) The scientist's position in China reached a low ebb as his work became secondary in importance to political activity and he was stripped of all privileges. For 10 years, pay raises were discontinued, which served to virtually eliminate material incentive for advancement.

(U) There were exceptions; some organizations were able to shield their personnel, to a degree, from political activity and therefore were able to prevent total disruption of R&D programs. This situation was particularly true for workers in defense R&D who were able to keep such programs as missile and space on track, though at a reduced pace.

(U) Both junior and senior S&T personnel were subjected to severe criticism and attacks during the Cultural Revolution. In some instances, Red Guard excesses included the physical abuse of these personalities and, directly or indirectly, may have caused the deaths of some. However, in general, secondary information sources e.g., from Hong Kong, Singapore, and Taiwan during 1966 and 1967 tended to greatly exaggerate the extent of such attacks. Typical of such reporting was a widely circulated story that a number of the "40-plus American-trained atomic scientists working on China's H-bomb have been caught in the latest Peking purge." According to the story, Qian Xuesen was included among the purged disgraced scientists. In fact, Qian apparently experienced little or no difficulty during the Cultural Revolution and was elevated to the Party Central Committee. He actually emerged from the turmoil with considerably more official prominence and recognition.

(U) Red Guard activity on campuses halted all R&D activity in schools during this period. Within the Academy of Sciences, research institutes, and other noneducational R&D facilities, the regime ordered the People's Liberation Army (PLA) to protect important researchers and research tasks from severe attacks by Red Guards. While this was not totally successful, in that the Red Guard's activities frequently exceeded the intentions of the leadership, it appears that high-priority R&D activities were well protected during the Cultural Revolution.

(U) In June 1966, the Central Committee and the State Council announced that the higher educational system was to be revised extensively. Radical changes were made in methods of student selection, grading, and curricula. The traditional system of entrance examinations for admission to institutions of higher learning was replaced by a system designed to favor the children of workers and peasants. As a result, a much higher proportion of politically trustworthy students would be admitted to the institutions. Changes in grading and curricula placed greater emphasis on the study of "proletarian politics." These changes reportedly were implemented initially in departments of liberal arts and social sciences and later extended to the technical fields. The resumption of higher education under the reforms announced during the Cultural Revolution resulted in the production of what was admittedly "tradesmen," and not highly qualified scientists and engineers.

A.3. Aftermath of Cultural Revolution (U)

(U) The Cultural Revolution created a two-track educational system. A relatively small number of students received full-time education in colleges and universities, while a much larger number received part-time education in a "Workers College" set up by factories along with other part-time programs run by the universities. In 1976, an estimated 1.8 million adults were enrolled in part-time programs.

(U) The part-time programs provided a lower level of vocational training. These programs were designed to raise the overall technical capability of the masses. In 1984, 540,000 students were enrolled in part-time programs.

(U) The two-track system continues, for the leadership has called for mass participation in the S&T modernization program. Part-time programs have been beneficial in providing greater technical capability among China's "blue-collar" work force. The emphasis in education, though, will be on upgrading full-time programs to standards equivalent to those in more advanced countries. Seventy-five percent of the student body will major in S&T disciplines.

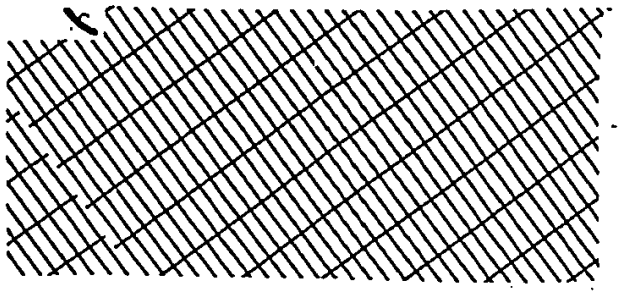
(U) The full-time programs emphasize middle-level technical and engineering training appropriate for current levels of production technology. Following completion of the training, students then return to factories, communes, and military units from which they have come.

(U) Perhaps the easiest way to summarize the changes in the education system that occurred during the Cultural Revolution is to contrast the objectives and practices of that period to those of the preceding decades. Prior to 1966, centrally regulated policies and standardized degree requirements determined the quality of education in the schools. During the Cultural Revolution, the concentration of educational resources and the emphasis on quality gave way to dispersion and pursuit of absolute equality. By and large, education was reduced to the lowest common denominator. The present regime is moving to correct all deficiencies in the education system.

B. TRENDS IN HIGHER EDUCATION ENROLLMENTS/GRADUATIONS (U)

(U) The Chinese demonstrated a renewed zest in their higher education system in 1977, by admitting a record 278,000 new students in colleges and universities. (See Figure 1.) The overall quality of those students cannot be determined, however, since many students were enrolled under the policies of the Cultural Revolution. Those policies emphasized enrollment of students from the worker, peasant, and soldier class based on their political correctness instead of their academic ability. Curriculums during the 1967-1976 period were a mixture of political training and applied industrial, problem-solving science studies. The Chinese termed the course of study "tradesman training." "Tradesman," also called "technician," identifies an individual that can make a practical and immediate contribution to the development of the economy.

(U) In 1978, the Chinese reinstituted a universal entrance exam requirement to ensure that only the most qualified students were enrolled in colleges and universities. Of the nearly six million prospective students who took the exam, only about half were recent middle school graduates; the rest were former students, workers, and soldiers.



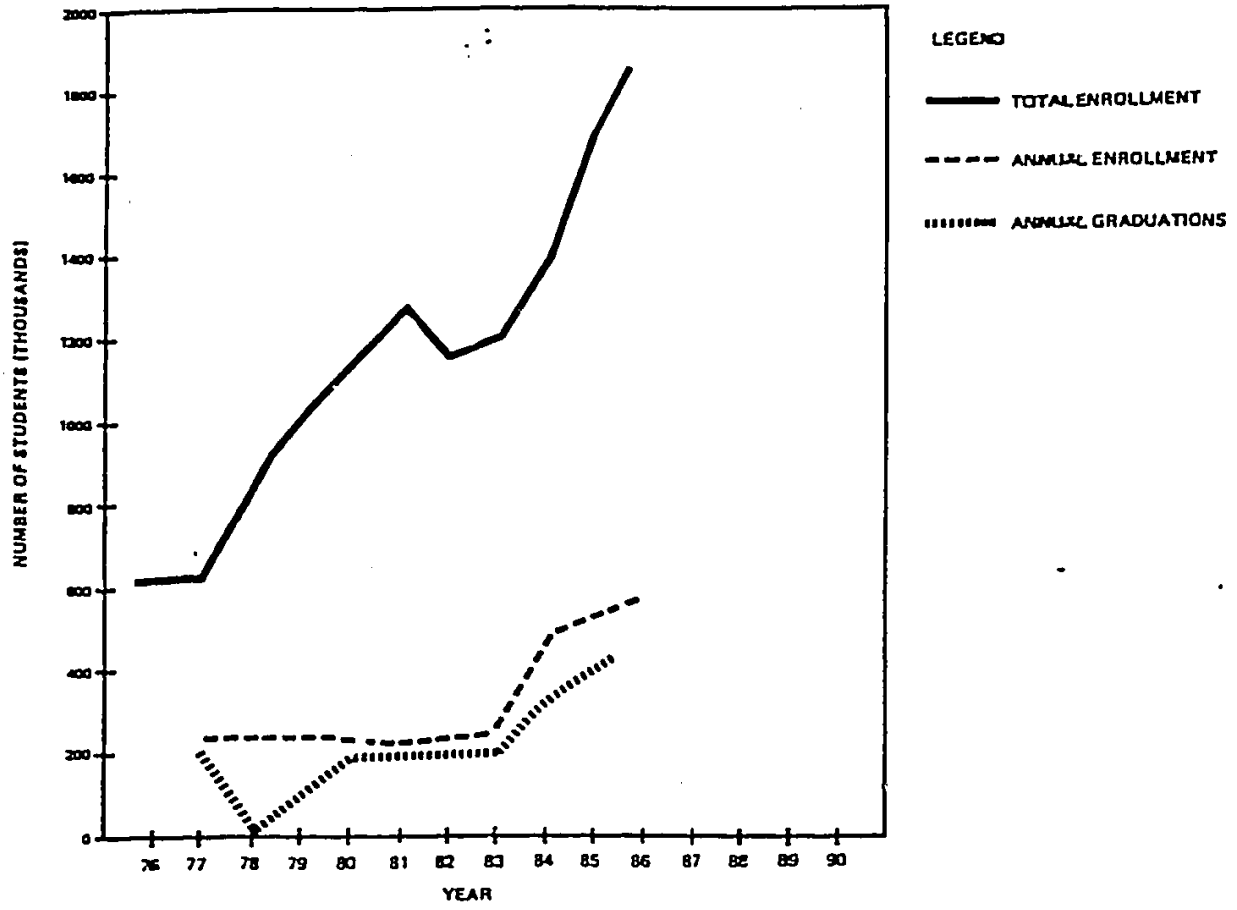


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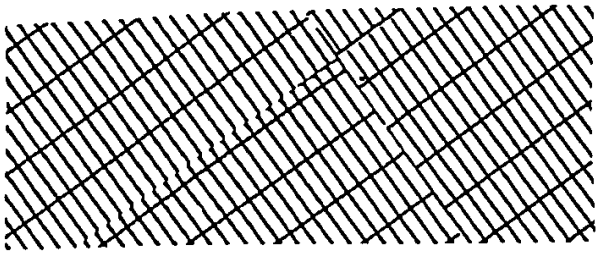
Fig. 1 (U) Chinese Higher Education Enrollments Graduations



(U) The urgency of producing more qualified teachers is evident since the Party and the government have embarked on a course of vigorously pushing modernization in science and technology. Therefore, higher educational institutions have been required to increase enrollment. In 1983, according to the Vice Minister of Education, college entrance requirements were lowered for students from rural areas. The fields they are expected to major in include agriculture, forestry, medicine and teaching. There seems to be a push to enroll more students to cover a wider variety of disciplines other than just science and technology.

(U) Secondary vocational and technical schools developed rapidly in 1986. There were 5.22 million students, 610,000 more than in 1985. Adult education also continued to develop. In 1986, there were 1.86 million students at adult universities and colleges, 1.51 million at adult secondary technical schools, and 4.42 million at adult technical training schools.

(U) After a sharp decline in 1978, the number of students graduating each year has increased. The number of 1978 graduates included those who had passed the first post-Cultural Revolution college entrance examinations given in 1977, as well as those who passed the second set of examinations administered in 1978. The lower number of graduates for 1979, 1980, and 1981 resulted from the extension of the curriculum from 3 years to

4 years for most students already in universities. The total number of university graduates in the years 1980-1985 was 1,535,000, which equals the total number of graduates in the 20 years before the Cultural Revolution; i.e., 1945-1965.

C. POSTGRADUATE TRAINING (U)

(U) Between 1949 and 1966, approximately 23,000 students were enrolled in China's postgraduate education system, with about 10,000 completing the program. Postgraduate enrollments began again in 1978, with an enrollment of approximately 10,500 students, or about half of the entire pre-Cultural Revolution figure. That first year enrollment figure included approximately 8,000 students in 210 universities and about 2,500 students in 162 research institutes. Only about 8,000 new students were enrolled in 1979 and approximately 3,000 in 1980. The decrease in 1980 was due to a saturation of the system. In 1980, 2,073 students graduated from the system, of which 1,666 or 80 percent were in science and engineering disciplines. Of the 2,073 students, 1,934 were enrolled in universities and 139 enrolled in research institutes.

(U) Graduate degrees were formally approved in 1980 after formal admissions began in 1978. Graduate enrollment in the post-Cultural Revolution began to rise after 1978. The number of students rose rapidly to 17,729 in 1980, and in 1982 reached 21,284. By 1983, over 350 higher educational institutions and over 300 scientific research organizations had admitted postgraduate students. The 1983 enrollment for master's degrees showed natural science and engineering disciplines accounting for 68 percent of the total enrollment figures. In 1984, the enrollment figures reached 23,500. In 1986, there were 110,000 postgraduates in study (41,600 enrolled in 1986 , 23,000 more than in the previous year, and 17,000 postgraduates completed their degrees.

(U) China will replace its current stipend system, a fixed sum of money paid periodically to defray expenses, for university and college students with a scholarship and loan system. Under the current stipend system, all students are subsidized regardless of their need, conduct, or academic performance. According to a report by the State Council, all university and college students except those who maintain good academic and conduct records should pay their own living expenses. There are three categories of scholarships: 1 scholarships for top students which will be used to encourage all-around excellence, 2 scholarships for students with specialities such as education, agriculture, forestry, sports, and marine navigation, and 3 scholarships for those students who work in poor, remote, or border regions after graduation. A loan system will be introduced for those students unable to cover their own expenses.

(U) Chinese education has improved by greater contact with Western scholars. The exposure to Western educational systems has helped define the educational aims the Chinese leadership hopes to achieve and the system for accomplishing these aims. China's indigenous graduate programs will undoubtedly benefit from foreign study.

(U) In 1984, China enrolled 2,080 doctoral degree candidates according to the Ministry of Education. The nation's first doctoral candidates (420 in all) were enrolled in 54 universities and 15 research institutes. About 1,000 began their studies in 1983. During the 1986 to 1987 academic year, Chinese universities enrolled 3,000 doctoral candidates selecting areas of study from 1,000 disciplines at 236 universities and institutes.

(U) The Chinese plan calls for a total of 928,000 postgraduates to be enrolled throughout the country in the 22 years from 1979 to 2000 and 758,300 to graduate before the year 1998. The postgraduates will become an effective force in higher education, scientific research organs, large-scale enterprises, and institutes of higher learning.

(U) China's determination to increase the level of graduate education is also evident in the rather basic structural changes that are being made in the training of advanced scholars. The leadership is now convinced that in order to improve both education and research, the system must be changed. More and more academicians have part-time teaching positions in the universities, while university professors hold advisory or administrative positions in various institutes of the Academy. Furthermore, in the last few years, the institutions of higher learning have been able to supplement their meager research budget by doing contractual research, especially for industrial enterprises.

(U) China has established 102 high-level scientific research training centers to promote the development of quality researchers. In order to accelerate training of high-level specialized talent, China has instituted post-doctorate scientific research training centers, enrolling 250 post-doctorate researchers throughout China in 1985 and 1986. The goal is to select certain PhD's to carry out a stage of research work at the scientific research training center in order to broaden the scope of their knowledge, to gain the experience to work independently, and to develop into high-level scientific researchers.

(U) Various colleges, universities, and research organizations with high academic standards and the best possible research facilities have set up post-doctorate scientific research centers. Students who have acquired PhD's in China or abroad are selected to carry out research for a specific period of time. Post-doctoral researchers will generally work for 2 years at a center. After

part-time schools. With the push to increase enrollment, there has been a need for more institutions.

(U) Of the 1,016 higher education institutes, 98 have been chosen as "keypoint" colleges whose role is to lead the way in raising the quality of higher education. They have priority in the choice of students, from among successful candidates at university entrance examinations, and in the allocation of resources.

(U) Universities have also established special links with some of the best middle schools in order to improve teaching and to attract the brightest students. The technical middle schools, almost completely suppressed during the Cultural Revolution, have been restored in order to provide a source of either good candidates to engineering colleges or well-trained middle-level technicians. China's institutions of higher learning have grown since the 1950's in roughly three stages: 1950-1965 (first stage), 1966-1976 (second stage), and 1976 to the present (third stage).

(U) Development during the first stage (1950-1965), when compared to the time prior to the founding of new China in 1949, was fairly fast. In 1965, the number of Chinese institutions of higher learning reached 434 (more than double the pre-1949 record) and the total enrollment reached 674,000 (4.4 times higher). Many university graduates trained during the first 15 years have become the backbone of their professions. Many of these graduates have emerged as well-known specialists and scholars at home and abroad.

(U) From 1966 to 1976 (second stage), China experienced the turmoil of the decade-long Cultural Revolution during which the development of institutions of higher learning came to a standstill and suffered serious setbacks. Between 1966 and 1969, according to the Commission, none of China's colleges or universities enrolled a single student. Many school buildings were turned into factory workshops or barracks, educational facilities were damaged or carelessly disposed of, countless books and materials were lost, numerous lecturers and professors were humiliated and branded as "reactionary authorities," and the majority of university faculty members were sent to countryside factories or to the army to do physical labor. Some universities were moved to out-of-the-way places, while others were closed down.

(U) During the second stage, a total of 106 colleges and universities were disbanded. By 1976, while some new ones were established, only 392 universities and colleges remained, and the number of students in school was 16 percent less than in 1965. Although China's institutions of higher learning began to enroll students in 1970, the national university entrance examinations were cancelled and the only candidates were workers, peasants, and soldiers recommended by their localities.

(U) With respect to educational levels, these "worker-peasant-soldier" students were uneven. Of course, some of them were well qualified, but there were many with only a primary school education. Disruption during the "Cultural Revolution" actually dragged China's higher education back dozens of years and planted a time bomb which exploded in later years in the form of a serious dearth of specialized personnel.

(U) The third stage (1976-present) began with the downfall of the Gang of Four (members of the Politburo in opposition to Mao Zedong) in 1976. Then, the Chinese government began to resuscitate the university enrollment and higher educational systems. University entrance exams were formally restored in December 1977, providing Chinese young people with an opportunity to continue their education. In 1985, the entrance competition was eased somewhat, but still only one out of every six taking the national examination was enrolled.

(U) In 1977, the rebuilding and development of China's institutions of higher learning started on a very weak foundation. A sharp increase in the number of schools and students provided a series of new problems and contradictions. Construction of school buildings lagged far behind growth in the number of students, which put a strain on the students' living conditions.

E. TYPES OF HIGHER EDUCATION INSTITUTIONS (U)

(U) Chinese higher educational institutions are of four basic types:

- Comprehensive Universities
- Polytechnical Universities
- Engineering Colleges
- Miscellaneous institutions (for agricultural and forestry, medical, teaching, etc.)

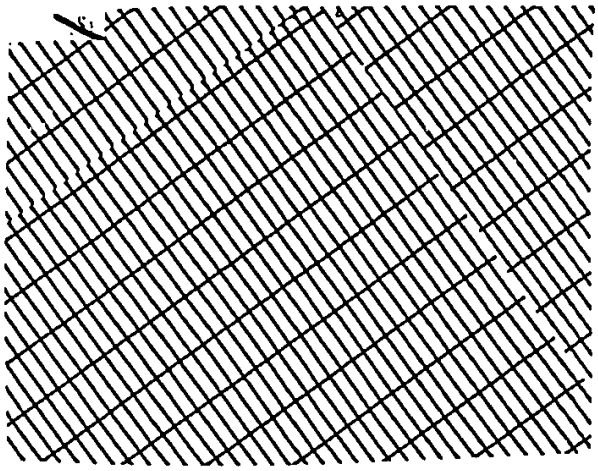
Only the first three types, however, are potential contributors of significant numbers of scientists and engineers to the Chinese S&T manpower pool.

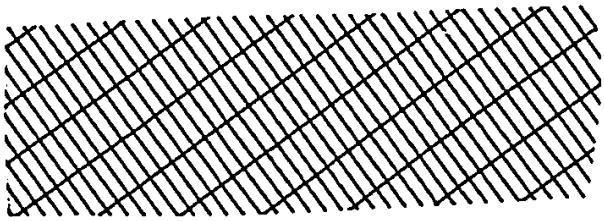
(U) Comprehensive Universities are institutions with multiple discipline programs including both the social and the technical sciences. These schools have the largest student population sizes in China. They have been centrally controlled organizations and usually have superior human and physical resources. Prior to the Cultural Revolution, such institutions generally had 5- or 6-year courses of study. An example of such a university is Beijing University. S&T graduates of these institutions have been assigned to research organizations

of the Academy of Sciences, defense industrial ministries, PLA, and other ministries. Comprehensive Universities currently constitute about 5 percent of higher education institutes.

(U) Polytechnical Universities, just as was true with Comprehensive Universities, tend to be large, high-quality, centralized institutions providing key technical manpower to several industrial sectors. Their teaching departments exclude the social sciences and are focused on the scientific and engineering disciplines. One of the leading polytechnical schools is Qinghua University, which has at least 12 academic subdivisions and approximately 8,000 students. Its engineering graduates work in higher education, research organizations, and other technical positions. Comprehensive and Polytechnical Universities are under the dual leadership of the State Education Commission (SEDC) and provincial Party elements, though the Academy of Sciences has a significant influence on their curricula.

(U) Engineering Colleges, both multi-course and single-course, generally are of a lower quality than the two types of universities. Their graduates generally are employed as technical cadres in production, rather than being assigned to leading research and educational facilities. Multi-course Engineering Colleges customarily support more than one sector of the economy, while single-course schools are quite specialized, frequently producing manpower for plants of a single industrial ministry. Both types, especially the single-course schools, frequently are found under the jurisdiction of the industrial ministries, which employ the schools' graduates. Some administrative control, however, is maintained by the SEDC and the local Party elements. Generally, these colleges emphasize the "practical" training of students, designers, engineers, and technicians. They are smaller than the universities with multi-course colleges, enrolling up to 6,000 students, while typical single-course colleges enroll about 4,000.





(U) The diversity of China and its economy justifies the expansion of its higher educational institutions. China's current drive to expand the higher institutions, however, is limited by facilities and qualified instructors. The Chinese are experimenting with part-time and full-time colleges and television classes in order to facilitate the progress of scientific and technological development. A variety of nontraditional alternatives are being implemented in China's post-secondary education. Alternative programs include correspondence courses, radio and television courses, and part-time courses at colleges and universities. There is no actual degree conferred; however, at the end of the course students are required to take examinations designed to measure their level of competence. The students are then assigned jobs based on their test scores which is much the same process students in higher education institutions go through. The Radio and Television Universities (RTVU) were opened in 1979. Students must pass a competitive test in order to be admitted to these universities. In 1983, 360,366 students were enrolled in full-time classes.

F. ACADEMIC DEGREES (U)

(U) Effective 1 January 1981, China began again to award academic degrees to students. This practice was eliminated beginning with the Cultural Revolution in 1966. The move attempts to standardize degree requirements within China, in common practice with other nations, and to push the modernization of China. An academic degree committee, chaired by Fang Yi, former president of the Chinese Academy of Sciences, developed the guidelines for the new program covering the three academic degrees of bachelor, master, and doctorate. In addition, the regulations stipulate that academic degrees obtained in foreign countries will be recognized, and academic degrees will be conferred on foreign students and scholars studying or doing research in China. Honorary Doctorates will be conferred on outstanding Chinese, exceptional foreign scholars and researchers, and noted public figures in recognition of their contributions. Renewing the practice of awarding academic degrees is a long-awaited and overdue event which should improve China's educational and academic levels.

(U) Commencing with the 1982 academic year, the Ministry of Education began to issue academic degrees to those who fulfilled the national requirements. In 1983, academic degree programs were established in

10 fields: philosophy, law, literature, history, economics, education, science, engineering, agriculture, and medicine.

G. OVERSEAS EDUCATION PROGRAM (U)

(U) Chinese reliance on foreign educational assistance to upgrade its S&T manpower resources is not a new tactic. The Chinese relied on some form of foreign educational assistance even before the Communists took power in 1949. Assistance to their educational programs has been provided by the US, Western Europe, Japan, and the Soviet Union. The current emphasis on overseas education is intended to help the Chinese professional S&T work force overcome the effects of the Cultural Revolution. It is perceived as the solution to their current problem in much the same way that sending students to the Soviet Union in the 1950's was done in order to overcome the pre-1949 state of the Chinese education system.

(U) Following the death of Mao Zedong Mao Tse-tung; in 1976 and the subsequent purge of the "Gang of Four," China expanded its S&T relationships with the rest of the world. Numerous Chinese scientists traveled abroad to attend conferences and symposiums and to explore foreign scientific centers. The Chinese also hosted numerous foreign delegations, seeking appraisal of their level of scientific ability. The Chinese were not pleased, however, with the results of their new relationships. It was apparent to all the participants that the Chinese level of S&T expertise was woefully deficient when compared with the level of their Western counterparts.

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(U) Since 1978, over 37,000 students have studied abroad; 26,000 of them were government funded, and 11,000 were self-supporting. Among the 14,000 students who have studied abroad and returned home since 1978, the majority are playing leading roles in scientific research and production according to the educational institutes. The total number of students studying abroad during the last 6 years doubles the number for the 28 years from 1950 to 1977. Also, before the Cultural Revolution, only 10 percent of these students were studying advanced courses. The percentage has now risen to 78 percent. The government selects young and middle-aged technical personnel and administrators for advanced studies.

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(U) Chinese students attending school abroad are of the highest caliber and are carefully screened. Chinese students go abroad either with support from the government or through private financing from relatives in China and abroad. Upon the completion of their studies, students are assigned jobs commensurate with their newly acquired skills. China's scientific elite has been almost exclusively foreign educated. Of the government sponsored students, three out of four are in engineering and the natural sciences. Students sent abroad major in such specialties as the natural sciences and engineering technology with emphasis on those areas in which China is currently working. China will continue to send students abroad to ensure advances in their technological capabilities.

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(U) Chinese authorities have announced that the number of state-supported students and scholars which will be sent abroad over the next 5 years will remain the same, but the number of individuals financially supported by local areas and institutions to go overseas will increase. No figures are available on how many government or privately sponsored students do not return.

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TABLE I

(U) POLITICAL SUPPORT FOR CHINESE SCIENTISTS/ENGINEERS

PRAGMATIC COALITION	LEFT-LEANING FACTION
On Political Work	
"The basic task of scientific research is to produce scientific results and competent people, therefore political activities should not hinder that task"	"Political and ideological work should be strengthened"
On Continuing the Revolution	
"Class struggle should be over among scientists and technicians"	"Scientists and technicians should persist in the revolution under the dictatorship of the proletariat"
On the Mass Line	
"Professional scientists and technicians are the main force for developing science and technology"	"We must rely on the masses for scientific and technological development"
On Mental and Manual Labor	
"There is no difference in mental and manual work because all are working in a socialist society"	"There is a difference and the difference should be reduced"
On the Merits of "Red or Expert"	
"Scientists and technicians that do not oppose the Party can make a contribution."	"Scientists and technicians must uphold Marxism-Leninism-Mao Zedong thought under the leadership of the Party"

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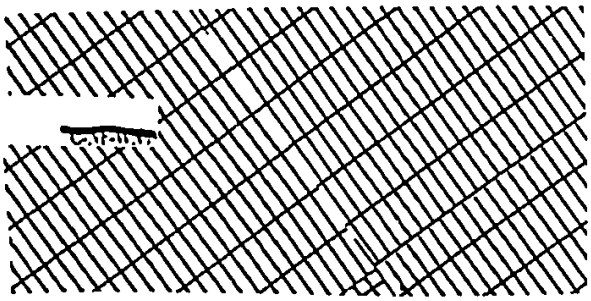

H. POLITICAL SUPPORT FOR CHINESE SCIENTISTS/ENGINEERS (U)

(U) China's ability to upgrade its professional S&T work force is greatly dependent upon the support of its political and scientific leadership. While top Party and state leaders share the common goal of upgrading China's S&T resources, each has distinctly different philosophies about the relationships of those resources to the Communist movement. Two factions (shown in Table I) exist within the Party hierarchy with the power to influence the future role of Chinese scientists and engineers: a pragmatic coalition led by the philosophies of Deng Xiaoping and a "left-leaning faction" still espousing the virtues and policies in effect during the Cultural Revolution. The stronger influence of the Deng-led coalition is reflected by the current liberalization of attitudes toward intellectuals and scientists in China.

(U) The pragmatic coalition emphasizes high-quality education and the role of professionals in developing science and technology. The coalition realizes that a great majority of Chinese scientists and engineers are not members of the Chinese Communist Party, and is trying to reduce the clash between science and politics to encourage their greater participation in the modernization program. Deng Xiaoping's present firm position should ensure continued support and improved education and scientific research.

(U) The left-leaning faction stresses mass participation in the S&T development process, but does not place a particularly high value on intellectuals nor theoretical scientists, especially those operating outside Party control. This faction believes that science and politics are inseparable and would burden the scientist with ideological restrictions. This group is more patient and is apparently willing to wait 20 years to see its goals achieved. The acknowledged leader of this group is Hua Guofeng, a staunch supporter of the political ideals formulated by Mao Zedong.

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I. NEW EDUCATIONAL REFORMS (U)

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(U) The State Education Commission (SEDC), established in June 1985, reflects the government's commitment to educational reform as a key factor in China's drive toward economic modernization. Headed by Vice Premier Li Peng, the SEDC is more powerful than its predecessor, the Ministry of Education. As a Commission of the State Council, it has the necessary bureaucratic clout to coordinate educational reform among the ministers. Among its tasks, the SEDC plans to initiate legislation to improve the training and status of teachers, increase administrative responsibility for colleges and universities, and draft a document on the reform of adult education. In addition, the SEDC will focus on two tasks: continuing to carry on the reforms in the educational field and opposing bourgeois liberalization. Li Peng feels college graduates should be given opportunities for practical training and strict examinations before they are assigned to work in government offices and research institutions of higher learning.

SECTION III

CHINESE SCIENTIFIC AND TECHNICAL MANPOWER RESOURCES (U)

A. BACKGROUND (1950-1976) (U)

(U) In 1950, one of the first acts of the new regime was to compile a roster of Chinese scientists and engineers in order to build a national R&D base. The survey revealed a severe shortage of S&T personnel available for R&D work. Approximately 850 scientists capable of performing significant R&D were identified. Of these, about 20 percent were not even in mainland China, but were working or studying abroad.

(U) In a 1956 speech to the Chinese Communist Party Central Committee, Zhou Enlai observed that "though there are a little more than 31,000 engineers of various grades in China, many of the 63,600 technicians who graduated from the universities and colleges, are now doing the work of engineers." He also referred to the existence of 5,600 intellectuals forming the "hard-core of the scientific research force," and said that positions of leadership were held by 5,600 members of scientific societies. From this, it can be inferred that in 1956, the Chinese estimate of the number of scientists competent to undertake and lead research in all programs was approximately 5,600 scientists and engineers.

(U) By 1958, the Chinese estimated that there were a total of 118,600 professional and nonprofessional R&D personnel available. Of these, 32,800 were scientists and engineers. These data, however, do not include the 10,000-20,000 professionals in universities and colleges who also may have been engaged to some extent in R&D.

(U) Many ethnic Chinese scientists living abroad answered a call in the early 1960's to return to China and assist in its modernization. That group, complemented by those receiving advanced education in the Soviet Union prior to 1962, formed the backbone of China's first S&T work force. The group numbered about 10,000, of which approximately 1,100 received doctoral-level degrees in the West and less than 2,000 received similar degrees in the USSR.

(U) By 1966, China was reported to have two million college graduates and approximately 800,000 scientists and technicians. Of that number, 650,000 were engineers, 85,000 were natural scientists, and 125,000 had received science training. The portion of that work force devoted to research and development is unknown.

(U) It is difficult to gauge the strength of Chinese S&T manpower resources in the 1970's due to the disruptions caused by the Cultural Revolution. In 1972, however, it is estimated that China had approximately 607,000 engineers and 113,000 natural scientists with only 100,000 of that work force estimated to be employed in research and development. Another source estimated that in 1973, the number of professional-level scientists and engineers directly engaged in R&D was about 70,000-80,000, or about one-tenth of the available S&T manpower pool. It is estimated that only about 10 percent of those engaged in R&D are capable of independent research.

(U) China's success in handing over power at all levels, even at the very top, to a generation of better educated, more technologically sophisticated leaders in their forties and fifties is well known. Many of these younger leaders either were trained in the USSR or rose through the ranks of industries and bureaucracies dominated by Soviet thinking and, in some cases, created by the Soviets.

(U) Soviet-trained Chinese represent only a small portion, probably about 1 percent, of Chinese college graduates during the 1950's. Even in science and engineering, those trained in the USSR constitute only about 3 percent of Chinese graduates in those disciplines. Similarly, only 12-18 percent of the members and alternates of the Chinese Communist Party Central Committee have a Soviet college-level background. Of the generation now coming to power, only Chinese roughly 50 years of age and above are old enough to have had substantial Soviet experience.

(U) The Chinese now talk about promoting a "third echelon" to positions of responsibility, but this "third echelon" is, in reality, made up of two age groups with rather different life experiences that have probably shaped their thinking differently. Members of the older group spent their adolescence in wartime China and grew into adulthood during China's "golden years" in the 1950's. Their attitudes were largely shaped by the prevailing optimism and nationalism of the late-war period and the economic success and relative political stability of the early 1950's.

(U) Chinese in their mid-forties, by contrast, are too young to have been significantly affected by the wartime atmosphere. They attended school during the heyday of the post-revolution in the 1950's, when getting a good education was seen as a patriotic duty and a road to personal advancement. Their political exposure to the adult world occurred during the Cultural Revolution. As a result, this younger group tends to be more elitist and more cynical.

(U) Both age groups were traumatized by the Cultural Revolution and now suffer from ambivalent attitudes and tensions brought about by the disjuncture between their training in education and the political reality of their early adult years. These tensions make their future behavior difficult to predict.

(U) The number of Chinese currently being trained in the US—about 14,000—has already surpassed the number trained in the USSR in the 1950's. By 1990, it will surpass the number trained in the West between 1940 and 1949. If current trends and current US policy continue, by 1990, China could be the source of the largest group of foreign students in the US. About two-thirds of the Chinese studying in the US are enrolled in engineering, physics, computer science, life sciences, and related disciplines. About one-third are in humanities, management, and social sciences. Some have already returned to China and been promoted to high office, including Chairman of the State Science and Technology Commission Song Jian and Chairman of the National Defense Science, Technology and Industry Commission Dong Henggao. Chinese students being trained in the US, however, have experienced problems of reabsorption as they reenter a Chinese system ill-equipped to support their expectations.

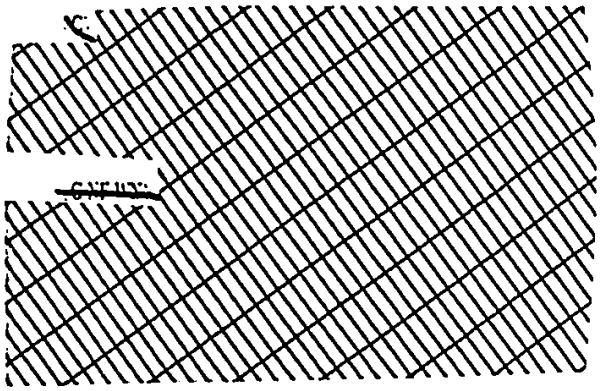
B. S&T MANPOWER ESTIMATES (1978-Present) (U)

(U) Reliable statistical data on Chinese S&T manpower resources did not become available until 1978. The new data were obtained from a Chinese survey conducted after the March 1978 National Science Conference. Though the exact results of the survey were never published, Fang Yi, then president of the Chinese Academy of Sciences, stated that there were approximately four million S&T personnel in China. In 1979, Zhou Peijuan, acting chairman of the China S&T Association, said, "China has only 300,000 to 400,000 people working in science and engineering, only 60,000 of which are qualified." In the same year, Qian Sangiang, an Academy official, stated, "The CAS has 23,000 researchers, and China has 2,400 research organizations with 310,600 researchers." Another source revealed in 1981 that there were approximately 80,000 women scientists working in natural science institutions, of which 5,151 were reported to be working in the Academy. The 80,000 figure was indicated to be 27 percent of the total scientists in China. In 1984, the number of natural science professionals and technicians reached 7.35 million. Enrollments in the natural sciences accounted for 7 percent of the total enrollment, with science and engineering at 36 percent. Women accounted for more than one-third of the workers in the scientific and technical fields. In 1986, the ranks of scientists and technicians continued to expand, with approximately 8.25 million natural science professionals and technicians employed in state-owned units, 440,000 more than in 1985.

(U) The overall quality of those approximately 300,000 researchers is highly suspect. Evidence can be found in Zhou Peijuan's reference to the existence of only 60,000 "qualified" researchers out of the 300,000-400,000 in the R&D labor force. The others lack the requisite education and work experience to be considered accomplished researchers. Consequently, the backbone of the Chinese S&T manpower pool is still that small core of scientists and engineers that are capable of performing independent research. As in past practice, these individuals are probably associated with the higher priority theoretical and military-associated programs.

(U) In addition, there is an acute shortage of technicians and trade school graduates in China which has forced graduates of regular four-year universities to take jobs that vocational and trade school graduates are equipped to handle. This phenomenon reflects the fact that in the 1960's and early 1970's little attention was given to developing technical and trade schools.

(U) In 1985, in order to boost their S&T labor force, the Chinese began retesting many of the 900,000 college graduates from the 1970-1976 period. Candidates had to pass exams in chemistry, mathematics, physics, and foreign languages in order to apply for posts as "assistant engineers." Approximately one-half, or 450,000, of the first group taking the tests in Beijing passed.



(U) Job mobility is one of the key elements in reforming scientific and technical personnel. State counselor Fang Yi urged that reforms in personnel management should begin with the introduction of mobility. In order to achieve the goals of the Seventh Five Year Plan (1986-1990), the Chinese are mobilizing their inadequately sized scientific and technical manpower base. Though the Chinese lack sufficient numbers of qualified scientists and engineers to perform broad-based research, they have demonstrated the ability to achieve

high priority goals. Job mobility involves the reassignment of scientists and engineers to national high priority projects. The transfers are coordinated at the highest levels of the Chinese government.

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D. COMPONENTS OF THE SCIENTIFIC AND TECHNICAL WORK FORCE (U)

(U) Due to the effects of the Cultural Revolution, Chinese S&T manpower resources are not of uniform quality. Many of the personnel are inexperienced or poorly trained and work with a minimum of competent scientific leadership. Much of the work is low-level research or engineering development. Officials admit that "only several thousand. . . are higher S&T personnel" capable of planning, supervising, and carrying out research of a quality that would be of interest to scientists in advanced countries. Of approximately 300,000 professionals engaged in R&D, it is estimated that about 10,000 engineers and natural scientists are capable of independent research; nearly one-half of these received advanced degrees from Western and Soviet schools. Since 1978, several thousand engineers and scientists have been trained abroad. An estimated 8,000 were educated in Japan, 12,000 in the US, and 3,000–4,000 in Western Europe. There is a large difference in capability between the foreign-trained cadre and the scientists educated in China prior to 1966. There is even a greater difference between these two groups and the personnel that are products of the Cultural Revolution education system.

(U) Augmenting the professional force is a much larger group of people that have received vocational-type training in part-time college programs. This work force provides China with a greater potential for applying scientific processes to production problems than would have been the case without part-time schooling.

(U) Over the past few years, leading groups in China's enterprises have undergone two large rectifications, the first in 1982-1983 and the second in 1984-1985. After these two rectifications, a large group of new people who fit the conditions for "modernization" were promoted to leadership positions of authority. Those in their forties formed the backbone of the enterprise leading groups. Based on statistics for 18,000 leading groups in more than 3,000 medium-sized to large key enterprises, 20 percent of them were under 40, 63 percent were from 41 to 50, and 17 percent were over 51; the average age was 45. At the same time, a group of engineers and technicians over 50 in various leadership and work positions of authority in enterprises retired. How to best utilize the engineers and technicians over 50 is a new problem that has been encountered by the enterprises.

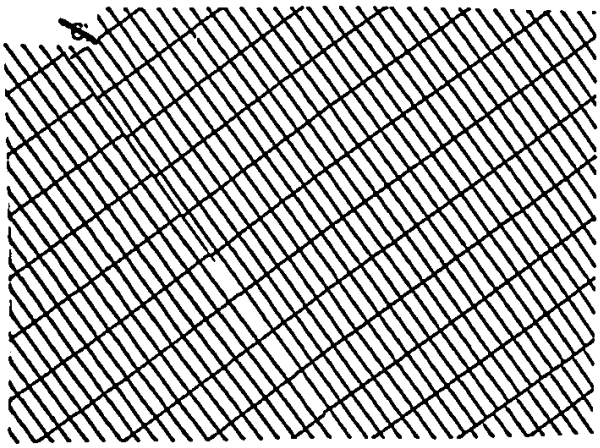
(U) For the most part, engineers and technicians over 50 are basically familiar with their work, knowledgeable of the situation, and rich in experience. In many factories built during the 1950's, they have been around as long as the factory and many know the histories and situations at their factories. They have contributed their best years and their greatest energies to these enterprises. For some 30 years, they have been buffeted back and forth but never lost their faith, and now, although they have reached retirement age, they still wish to contribute their experience and knowledge.

(U) There are three general groups of scientists and engineers in China, based on education and work experience.

D.1. Group I (U)

(U) Of the many thousands of Chinese nationals trained abroad prior to 1951, approximately 5,500 S&T graduates elected to return to China; 20 percent of that group held doctoral degrees or an equivalent level of training. Group I is composed of the cadre remaining from that original 5,500. The scientists and engineers educated outside China compose the leadership, managerial talent, and key researchers of the nation's current S&T community.

(U) Group I's average age is in the late 60's. The group has extensive leadership and research work experience in China and is the backbone of the professional S&T manpower force. Most of the group received advanced degrees in the West or USSR and are skilled in at least one foreign language. This group constitutes less than 1 percent of the professional S&T work force.



(U) The shortage of qualified R&D personnel in China is being compensated for by having Group I personnel assigned a multiplicity of research responsibilities. Each of these scientists works on several priority research projects at Academy institutes, institutes of industrial ministries, technical colleges, and universities simultaneously. The competent men are brought together to work in research task forces that cut across the administrative lines of the organization of their primary employment. Such a task group approach is used particularly in high-priority military R&D. Senior scientists and engineers from all over China have been welded into working groups to develop nuclear weapons and aerospace systems.

(U) Although foreign training has enhanced the careers of many, there have been periods over the past 20 years when a foreign outlook has been a professional and personal handicap. There have been many instances of disapproval and harassment of senior scientists whose former associations with the West or the USSR make them appear to be suspect or disloyal elements. On the whole, however, Chinese utilization of foreign-trained scientists and engineers in high management and research positions seems to be a rational approach to attainment of high-priority goals in the military and industrial sectors of the Chinese economy.

(U) China has been, and will continue to be, dependent upon the first group for some time. One of the crucial issues in the prospects for S&T manpower development is whether adequate replacements for them can be trained. Toward this end, China has reimplemented domestic postgraduate and overseas education programs.

D.2. Group II (U)

(U) The second group has an average age between 50 and 50. A small percentage was educated in the USSR, but many of those studying in the Soviet Union had their education disrupted with the split between the Soviets and China in the early 1960's. The great majority are products of Chinese education prior to the Cultural Revolution. Consequently, educational background can be judged overall as adequate for scientific and engineering work, but work experience suffered greatly during the Cultural Revolution. This situation served to severely retard the continuing learning experience in their professions. They have some foreign language capability, mainly in reading, but they are not generally proficient in languages due to their lack of exposure to foreigners for many years. They constitute about 35 percent of the S&T work force and have the highest potential for development with training and broader work experience.

D.3. Group III (U)

(U) The third group is a product of a Cultural Revolution education with an average age between 31 and 40. Estimates of the group's capability as scientists and engineers range from inept to barely proficient. Most of this group were "soldiers, peasants, and workers" who gained entrance to universities on political merit rather than academic talent. Most returned to the military units, factories, and communes from which they came and are now engaged in production functions. They have little or no foreign language capability.

(U) Undoubtedly, there are some intelligent, capable people in this group, but their number is probably extremely small. Within this group would be those who studied and worked in tutorial relationships with senior scientists. The prospects for any meaningful development

of this group, which constitutes about 24 percent of the work force, are extremely small.

(U) Eventually, the middle-aged people with professional skills vital to socialist construction will be old people ready to retire. But among the young people between the ages of 21 and 30 who will take their places, very few have the educational level of a technical secondary school graduate or above. This situation will lead to a gap in the ranks of qualified personnel according to the Deputy Director of the National Works and Education Staff.

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E. [redacted] (U)

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SECTION IV

(U)

A. INTRODUCTION (U)

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Fig. 3 (U)

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TABLE II

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C. [redacted] (U)

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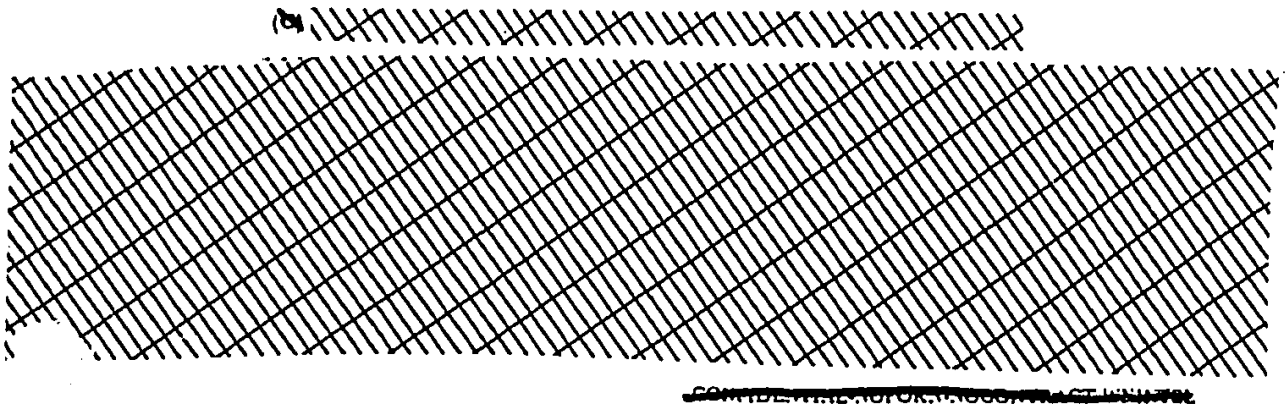
TABLE III



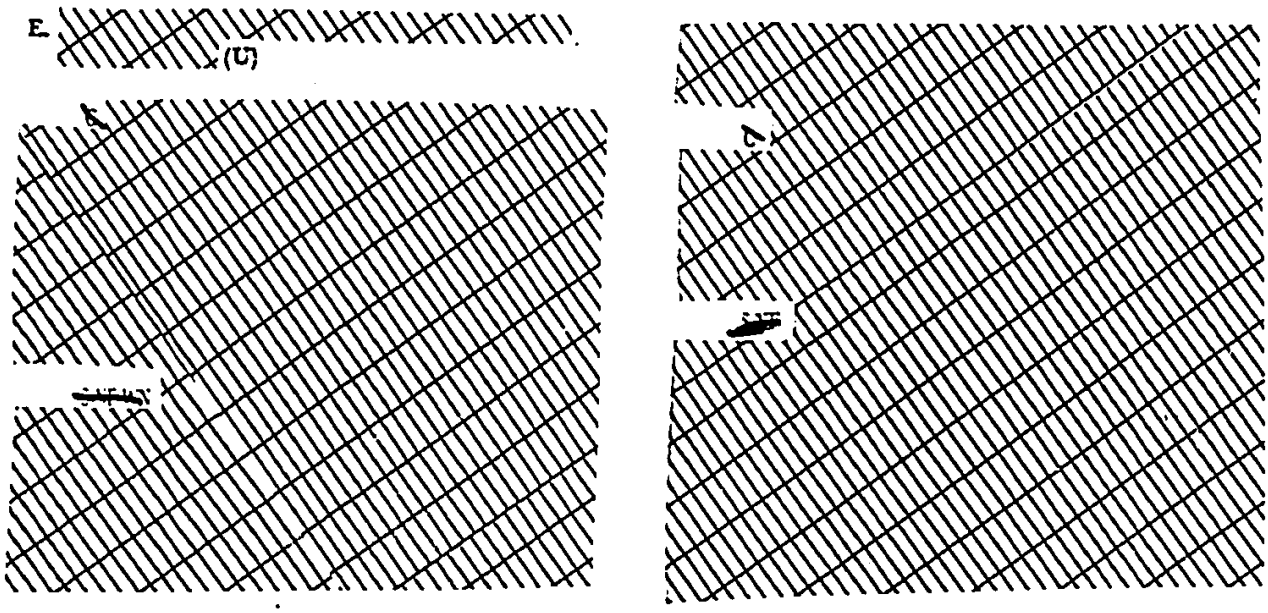


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TABLE IV